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## (54) STERILIZABLE CURING COMPOSITION FOR DENTAL USE

## (57) Abstract:

PURPOSE: To obtain a sterilizable curing composition for dental use, having high durability and safety without using a germicide, being utilized a photoelectrochemical germicidal action of titania by mixing titania fine powder on which a metal such as platinum or titanium is carried.

CONSTITUTION: A sterilizable curing composition for dental use obtained by mixing titania fine powder (rutile type or anatase type, preferably having 5 $\mu$ m particle diameter) carrying thereon a metal (pref. platinum, palladium or titanium and a base metal such as silver or nickel, where nickel is used for seal material or gypsum model). When a cured body of the composition containing the metal-carried titania fine powder exposed on the surface of tooth is illuminated with proper visible light, it is effective for prevention of caries and periodontal disease or prevention of malodor, because the cured body and the peripheral tooth part are sterilized. When the cured body contained in the inside of tooth is illuminated with visible light capable of permeating tooth, sterilization effect is given and is effective for prevention of diseases inside and deep part of the gum.

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The sterilization nature hardenability constituent for dentistry which mixes the titania fines which supported the metal and changes.

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## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

## [0001]

[Industrial Application] this invention relates to improvement of the sterilization nature hardenability constituent for dentistry which gave the sterilization function to the dental-filling repair material for dentistry, and prosthesis fabrication auxiliary material.

## [0002]

[Description of the Prior Art] In an odontotherapy, the treatment which carries out restoration, application, or dishing up for a filler or repair material to ablation and disinfection, or removal of a tooth pulp after disposal, such as widening of hole and disinfection, and carries out plastic surgery restoration of the tooth concerned is made by the deficit section and the illness root of a root canal by the cariosity of a tooth. Moreover, the treatment filled up by the prosthesis is made about the tooth lost by periodontoclasia.

[0003] These treatment is faced. The porcelain which sticks on the prosthesis and tooth front face which substitute for the sealing material which seals the pore which passes to a dentine, the binder for dentistry which pastes up other members on a tooth side, dental cement, the composite resin which carries out the loss-of-tooth section with the supplement peak, photopolymerization resin, the primer applied to a tooth side, or a loss tooth from \*\*, the root-canal-of-tooth filler precisely filled up with the inside of a root canal of tooth, and a root canal of tooth, and restores a crown etc. is used.

[0004] These dental material is an application and the thing which it pastes up and fills up with, hardens and is held over a long period of time as a solid at the tooth section in the front face of a tooth where the part was lacked, or a root canal of tooth. Although it is, produce a cavity in this solid in the case of treatment, a gap is produced in a part of adhesion side with a tooth, or sealing [ of root-canal-of-tooth \*\*\*\* ] becomes imperfect with the source of propagation of a bacteria during years of use, risk of producing the disorder of root-canal-of-tooth \*\*\* or \*\*\* becomes high, and the cure is demanded.

[0005] About the root-canal-of-tooth filler, the root-canal-of-tooth filler which blended antibacterial material with the conventional technology with X-ray imaging material is known, for example, it is a \*\*\* type and the filler which is polyacrylic-acid system water and uses iodoform or a chlorhexidine hydrochloride for powder material at solution at antibacterial material including alpha-phosphoric-acid tricalcium, hydro KYAPA tightness, X-ray imaging material, and antibacterial material is indicated (JP, 62-19508, A).

[0006] Moreover, resin for a crown restoration which the antibacterial hardened material which blends an antibacterial zeolite with the hardened material for dentistry beforehand is also proposed [ resin ], and made the zeolite contain (JP, 1-290612, A), The flooring for the prostheses made from resin (JP, 1-254608, A) which blended the zeolite for the purpose of suppressing propagation of the bacteria adhering to the resin crown front

face near the gingival margin, and preventing a periodontal disease tends to suppress proliferation of the fungus and mold adhering to the prosthesis basal surface. Furthermore, the antibacterial porcelain which blends a zeolite with the porcelain and is really calcinated is also proposed (JP, 1-275507, A).

[0007] In adjustment of a prosthesis, an impression is extracted by the impression material, the counterdie of the solidification impression material is obtained from a patient's gear-tooth jaw, subsequently to this counterdie baking plaster is slushed, a plaster model is produced, and the plate, and PURIJJ1 and a crown are adjusted on the basis of a plaster model. In the case of creation of the impression extraction from a patient, and a plaster model, the dentistry way person and prosthesis maker to whom a patient's bacteria etc. adhere through a patient's saliva and blood, and the impression material and a plaster model deal with these always have risk of being infected with bacteria.

[0008] The alginate impression material which made the disinfectant contain is beforehand proposed by the conventional technology (JP, 1-100110, A), and it is going to intercept the infection which minds the impression material by the germicidal action of disinfectants, such as blended gluconic-acid HEKISHIJIN, on it.

[0009]

[Problem(s) to be Solved by the Invention] Since hardening material for dentistries, such as restoration material of a tooth, fixes to a tooth for a long period of time and the hardening is demonstrated, although the germicide and the antibacterial zeolite which were blended with the hardening material concerned are stability for a long period of time and the fixed effect of a medicine needs to be maintained Possibility that the sterilization effect will carry out reduction disappearance by elution and decomposition of a sterilization component during use for years is high. moreover, a zeolite Bacteria are adsorbed, the activity is reduced, propagation is only suppressed, bacteria are not annihilated, and neither generating of the disorder of the tooth section of self nor the infection to others can be prevented [ therefore ] completely.

[0010] Moreover, at the point which can sterilize certainly the bacteria which adhered to the gear-tooth jaw by press at the impression material, although combination of the disinfectant to the impression material is effective, it has some which have a problem in the harmfulness to a human body on the contrary like the above depending on a disinfectant component.

[0011] If it continues till recent years, a metal and a titania are contacted on the other hand and light is irradiated, behavior of the titania is carried out as an optical semiconductor, and it is found out that remarkable sterilization nature is shown underwater.

[0012] this invention tends to offer the hardenability constituent of the high sterilization nature for dentistries of durability and safety using the photoelectrical evaporation study-germicidal action which a titania has, without using a germicide, and tends to cope with many above-mentioned problems.

[0013]

[Means for Solving the Problem] It is characterized by the titania fines which supported metal fines being mixed by the hardenability constituent for dentistries of this invention.

[0014] Although you may be an anatase type even if titania fines are rutile types here, the gestalt which is fines 5 micrometers or less preferably, and is supporting the metal 100 micrometers or less of particle diameters is required. As a metal supported, from a viewpoint of harmfulness over a human body, platinum, palladium, or titanium is the best for the hardenability constituent in the case of being fixed to a tooth at a long period of time, and, subsequently base metal, such as silver, gold, and nickel, etc. is usable to it. Moreover, nickel is used to the impression material or a plaster model.

[0015] What the metal and the titania particle fixed, only kneaded the metal powder and the titania particle, using what metals, such as platinum, fixed on the front face of a

titania particle that what is necessary is just in the state of being electrically in contact, and was supported on the mutual front face is sufficient as the gestalt which makes a titania support metal fines. For example, titania fines are distributed in the method of adding titania fines, performing optical irradiation and making a platinum coat putting into platinate tetrachloride solution, the method of carrying out the vacuum evaporationo of the platinum to titania fines in a vacuum, and the electrolytic solution containing nickel salt, and conventional methods, such as the method of carrying out electroless deposition of the nickel to a particle front face, can be adopted. Moreover, heating at high temperature of the briquette which carried out compression molding and obtained the mixed fines of metal titanium and a titania as the mechanical method is carried out in a vacuum, after cooling, it can grind and the method of repeating compression and trituration and uniting the mixed fines of method metallurgy group titanium and a titania made into sintering fines can also be adopted again.

[0016] Like the after-mentioned in the hardenability constituent for dentistries, usually, it consists of the combination of powder material, solution or solution, and solution before use, it mixes both on the occasion of use, and blends the shape of a paste, and the titania fines concerned which supported the metal to solution or powder material beforehand in this invention although it was used for the predetermined tooth part and hardened as liquefied. The titania fines which supported the metal are mixed by the impression material or plaster for a root-canal-of-tooth bulking agent, a sealing material, a surge cull pack, dental cement, a primer, composite resin, hard resin or photopolymerization resin, a resin prosthesis, or prosthesis adjustment, and the sterilization nature hardenability constituent for dentistries of this invention is constituted. this invention is explained as a mode of operation below.

[0017] a root-canal-of-tooth filler -- the opening of the pulp cavity after treatment -- supplying -- perfect -- blocking -- a root canal -- the root tip of a pars basilaris ossis occipitalis, although the bacterial infection path between a hole and the periodontium and between a root canal and the oral cavity is intercepted In this invention, in the powder material which makes a principal component X-ray imaging material, such as a zinc oxide, rosin, and a barium sulfate, blend the titania fines which supported the above-mentioned platinum or titanium, and use is faced. It mixes with the solution and the above-mentioned powder material containing the eugenol, and as the shape of a paste, a root canal of tooth is filled up and stiffened. Moreover, the titania fines concerned are added by the calcium-hydroxide powder concerned to the bulking agent of a calcium-hydroxide system.

[0018] Although dental cement is fusion of a prosthetic appliance, restoration of a cariosity cavity, pulp-capping material, lining material, and a curing agent with which construction of a bridge abutment is presented and the kind is various The zinc phosphate cement which will use the reaction of a zinc oxide and a phosphoric acid if it illustrates, The polycarboxylate cement using the reaction of a zinc oxide and a polycarboxylic acid, What is stiffened according to an acids [, such as glass ionomer cement using the reaction of an aluminosilicate and a polycarboxylic acid, ]-alkaline reaction is used, and the titania fines which supported the above-mentioned metal in the powder material containing an alkali component are mixed in this invention. Also to the cement of other types, the titania fines concerned are similarly mixed by powder material or solution, and the dentistry cement of sterilization nature is formed.

[0019] In advance of the application of the above-mentioned cement for adhesion to a tooth, addition combination of the titania fines which instead supported the above-mentioned metal in addition to the inorganic filler is carried out also to the sealing material for dentine capillary restoration in advance of the above-mentioned root-canal-restoration agent also to the primer applied to a tooth front face, and the sterilization nature primer or sealing material of this invention can be constituted.

[0020] Although composite resin and hard resin are the hardening objects with which restoration of cariosity \*\*\*\*, restoration of the deficit tooth section, and \*\*\*\* of a

crown are presented and it can use as adhesives widely. The liquefied polymer of the former to a polyfunctional (meta) acrylic-ester derivative, The 2 liquid type hardenability constituent which makes a major component a polymerization initiator and a filler like silica fines is widely used from the former, it is the 1 liquid type which consists of the same liquefied polymer and the same photopolymerization initiator, a reducing agent, and a filler, and photopolymerization resin is a constituent which carries out polymerization hardening by light irradiation. In addition to the filler concerned, in this invention, the resin for the departments of a composite resin isodont of the sterilization nature which mixed the titania fines of the above-mentioned metal support can be constituted.

[0021] In addition to a filler, the titania fines concerned are mixed and the constituent for sterilization nature false teeth is constituted. It is applied also like the false-tooth flooring made from resin, or back \*\* material.

[0022] After hardening, for adjustment of appearance and occlusion, the front face is cut and the resin for these restorations and a resin false tooth are carried out in a smooth side. Although a filler is blended in order to give the gloss and color tone of a dentine and to raise the intensity of a hardened material originally, in this invention, titania fines are mixed by the filler and it is suitably used for the resin the object for restoration used for the part which can view a tooth, or for false teeth.

[0023] The bandage material called the surge cull pack which consists of the powder material which makes a zinc oxide a principal component, and the liquid medicine which makes YUJINORU a principal component is contained in the sterilization nature hardenability constituent of this invention, and the titania fines of metal support are blended with it into the powder material concerned in this case. Make the bandage material of this invention into the shape of a paste, install on the marks which deleted the gum edge by gingivitis as an object for dentistry, they are made to solidify, sterilization and recovery promotion of the affected part concerned are aimed at, and infection is prevented.

[0024] In the impression material for false-tooth adjustment, usually, although alginic-acid impression material is used widely, in this case, this invention blends the titania fines of the above-mentioned metal support, is constituted, and it is used into the powder material which consists of fillers, such as an alginate, a calcium sulfate, and diatomite, mixing with water. In addition to this, this invention is applied also to agar impression material. Moreover, to the plaster of Paris for plaster models, into plaster-of-Paris fines, it mixes with the titania fines of the above-mentioned metal support, and the sterilization nature plaster of this invention is formed.

[0025] The loadings of titania fines to the above-mentioned sterilization nature hardenability constituent Although it changes with the kind of the hardened material, or, the difference of whether exposure is carried out by which a use and a hardened material are involved by the dentine, needs for sterilization, etc., a root-of-tooth pipe filler is received. To dental cement, it \*\*\*\*s [ among powder material ] to 1 - 50 % of the weight among powder material to plaster one to 75% of the weight to the resin for dentistry one to 35% of the weight one to 50% of the weight to the one to 20 section, and impression material to the resin 100 section among powder material among powder material. In addition, according to precision, a degree of hardness, and endurance, these loadings are within the limits and can be changed [ above-mentioned ] suitably, respectively.

[0026]

[Function] If the titania particle which supported the metal irradiates light by the damp or wet condition, while a titania will act as an optical semiconductor, and the electron of the valence band of a titania will be excited and shifting to a conduction band It leaves an electron hole to a valence band, it reacts with water by the titania interface, and they are OH radical or oxygen O<sub>2</sub>. By making it generate, the electron in another side and the conduction band of a titania is conducted to the metal joined with the titania

front face, discharges by the surface of metal, and it is hydrogen H<sub>2</sub>. It generates. The photoelectrical evaporation study-reaction by optical irradiation of this titania can participate in sterilization closely, and can annihilate effectively the bacteria and fungus of a cariosity bacillus and others which exist in Escherichia coli, Pseudomonas aeruginosa, Staphylococcus aureus, a Bacillus subtilis, black mold, and the oral cavity. About irradiation light, ultraviolet rays are not needed but sufficient sterilization effect is produced in sunlight, especially the light of a fluorescent lamp.

[0027] the above-mentioned metal support titania fines -- the powder material of a hardenability constituent -- or since it is mixed in the filler, it is distributing uniformly in the hardened material which kneads and carries out application restoration and changes

[0028] The titania particle concerned which exposed to the hardening body surface concerned the portion of the hard object formed by exposing composite resin, hard resin, photopolymerization resin, or a resin false tooth out of a dentine although the front face was made smooth by polish sterilizes the hardened material front face and the joined tooth front face by optical irradiation. If the resin of the titania combination concerned for repair is used for the tooth position laid especially under the gum marginal lower part, it is effective in sterilization of a gear-tooth periphery, and prevention of the periodontal disease of the gear-tooth periphery concerned after medical treatment is possible.

[0029] A false tooth and a resin false-tooth floor are cast by the resin of titania fines combination, and since the titania exposed to the hardening body surface gives the sterilization effect, it becomes effective in the sterilization in the oral cavity, and bad smell prevention.

[0030] Even if \*\*\*\* by the cavity or the adhesive agent arises about adhesives and dental cement in the case of hardening, the fungus which tends to breed in the cavity concerned etc. can be annihilated according to the sterilization effect of a titania, and the new cariosity which tends to be generated in jointing can be prevented.

[0031] In a filler or a sealing material, the bacterial infection from the oral cavity to \*\*\*\*\* of the root-of-tooth jurisdiction section and bacterial breeding can be prevented according to the sterilization effect of the titania fines concerned currently distributed.

[0032] Although it is necessary to irradiate light in order to give sterilization nature to the above-mentioned hardening object fixed to the tooth section in the oral cavity, if it is [ dentistry ] under medical treatment, it will illuminate on the hardening object concerned with a visible-ray irradiation vessel. Since the dentine is translucent, the boundary section which touches a dentine can be illuminated also to the root-of-tooth pipe filler by which interior was carried out to the dentine. Moreover, if a mouth is opened and the lighting light of a fluorescent lamp is taken in even if it is in ordinary homes, it is possible to illuminate a resin hardening object.

[0033] If the impression material or plaster which blended the titania fines of metal support holds an impression extraction rear stirrup under fluorescent lamp lighting by the damp or wet condition promptly after a plaster Chinese poem type, it can sterilize the front face of the hardening object easily.

[0034]

[Example] First, manufacture of the titania fines which supported the metal is shown below. Titania fines used the titanium white (average grain size of 1-100 micrometers) as the raw material, and used the platinum foil (thickness of 10-50 micrometers) for the metal. The platinum foil was first held on the base material, titania fines were fused to this on the thermal-spraying torch, and carried out thermal spraying to it, the titania coat (before or after 50 micrometers of thickness) was formed, this was ground, and \*\*\*\*\* titania fines with an average grain size of 10-150 micrometers were obtained.

[0034] the root canal which used these platinum support titania fines -- the example of combination applied to a filler, photopolymerization resin, impression material, and

plaster is shown below

(1) a root canal -- a filler -- (\*\*) -- composition base-resin (powder material) zinc oxide 39% (a weight ... below the same)

Rosin 29% self-extinguishing 14% barium sulfate 14% titania fines 4% liquid medicine CHUJI oil 80% olive oil A (b) manufacture base resin and liquid are mixed a proper quantity every 20%, and it considers as the shape of a paste, and is filled up within a root.

(c) As the outcrossing total amount, 1 - 50 % of the weight is suitable outside this example. If titania fines are less than [ this ], sterilization nature is not enough, and with this [ more than ], a packing effect falls.

[0035] (2) At photopolymerization resin, they are a total of 100 sections titania fines more than a (b) composition poly SHIANU rate vinyl compound polymerization initiator. 5 section (b) manufacture above was mixed and it considered as photopolymerization resin.

(c) In addition, as an example of combination, the one to titania fines 20 section is suitable to the resin 100 section outside this example. If titania fines are less than [ this ], sterilization nature is not enough, and with this [ more than ], the intensity of resin and endurance deteriorate.

[0036] (3) At impression material, it is a (b) composition sodium alginate. 15-% of the weight calcium-sulfate 2 monohydrate The 15-% of the weight 3rd sodium phosphate 2-% of the weight talc 10-% of the weight diatom earth 48-% of the weight titania fines The (b) manufacture above was kneaded 10% of the weight, and impression material was made.

(c) In addition, as an example of combination, the titania fines in powder material can be blended one to 75% of the weight outside this example. Sterilization nature is not enough in accurate impression material not becoming that titania fines are more than this, and intensity running short, and it being less than [ this ].

[0037] (4) With plaster, they are the (b) composition plaster-of-Paris 100 section and the platinum support titania 20 section.

The above was mixed and it considered as powder material.

(b) Water was blended with the powder material of \*\*\*\*\*\*, plaster mud was adjusted, and it slushed into the shade type of the above-mentioned impression material, and considered as the plaster model.

(c) In addition, as an example of combination, it can blend one to 50% of the weight among powder material outside this example. Intensity runs short that titania fines are more than this, and the setting time becomes long. Sterilization nature runs short that it is less than [ this ]. In addition, especially, as a result of irradiating a fluorescent lamp and inspecting it in the bacterial culture liquid in a petri dish using Pseudomonas aeruginosa, these sterilization nature has been sterilized, when holding 30 minutes or more. in order that a titania may not show harmfulness to a living body — this invention -- polymerization resin and a root canal -- it can be used, without completely doing damage to a human body, even if it uses it as a filler

[0038]

[Effect of the Invention] The following effects can be done so if the sterilization nature hardenability constituent for dentistry of this invention is carried out. That is, if the light is irradiated suitably at the hardening object of the constituent containing the metal support titania fines concerned exposed to a tooth front face, the hardening object concerned and its circumference tooth section are sterilized, and are effective in prevention and bad smell prevention of cariosity or a periodontal disease.

[0039] Moreover, by irradiating the light which penetrates a dentine to the hardening object concerned built in the interior of a dentine, the hardening object concerned expresses the sterilization effect with the boundary section which touches a dentine inside, and is effective in disease prevention of the interior of a dentine, or the gum depths.

[0040] Since sterilization nature is furthermore given to impression material and a plaster model only by carrying out optical irradiation, the infection route of the

bacterial pathogen in the patient oral cavity can be intercepted, and generating of infection can be protected from the pursuer of false-tooth manufacture process.  
[0041] Without [ therefore ] not carrying out raw [ of the harmfulness ] to a human body at all, and exhausting like a germicide, as long as platinum and titanium are used for a metal, the titania which supported the metal is very safe for the hardening object of this invention also to years of use in the oral cavity, and can guarantee the durability of the sterilization effect.

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[Translation done.]